PITTSBURGH GEOLOGICAL SOCIETY

DECEMBER 20, 2017

Social hour	**6:00 PM**
Dinner	**7:00 PM**
Program	**8:00 PM**

Dinner costs
$30.00 per person
$10.00 student member

Reservations
Email your name and number of attendees in your party to: pgsreservations@gmail.com

You can also reserve and pay via PayPal on: https://www.pittsburghgeologicalsociety.org/

Location
Foster's Restaurant
Foster Plaza Bldg. 10
Green Tree PA

Some Warm and Hot Places on a Cold Evening

Dr. Michael Bikerman

Emeritus Professor
University of Pittsburgh

Deadline for reservations is noon on Monday, Dec 18.

SPEAKER BIOGRAPHY

Michael Bikerman is an emeritus geology professor from the University of Pittsburgh [PA] who taught physical geology, historical geology, geochemistry, ore deposits, general geology, the geology of National Parks, and World Geography. His research specialty was largely in K-Ar dating of Cretaceous to Neogene volcanic rocks, plus studies in metamorphic/plutonic terranes.

He earned a BS in chemistry at Queens College [NYC], a BS in geology at NMIMT-now New Mexico Tech [Socorro, NM] and MS and PhD degrees in geology at the University of Arizona [Tucson, AZ]. He was a registered professional geologist in Pennsylvania, now retired, and is an honorary member of PGS.

Michael went around the world three times on Semester at Sea, an academic program introducing undergraduate students to the world, as a geology professor on the S91 voyage and as the Academic Dean on the F00 and F04 trips. Since retiring he has shared his lifelong love of Planet Earth with occasional classes in geology and world geography at the Community College of Allegheny County, at Duquesne University, for groups in the Mt. Lebanon, PA public library, and in retirement communities. He is a volunteer at the Mt. Lebanon Public Library Book Cellar.

He has lectured successfully on cruise ships - on Royal Caribbean to Alaska, on Regent Seven Seas twice – a trans-Atlantic cruise and one through the Panama Canal. His latest have been on Holland America: a Hawaii-to-San Diego-and-back cruise, two Trans-Atlantic repositioning cruises, three Hawaii/French Polynesia cruises, three Panama Canal traverses, two western South America and one eastern South America cruises, and a Singapore – Indonesia – Australia trip.

Other recent travel has been to Colombia, France, Turkey, Peru [Machu Picchu] and Ecuador [Galapagos and volcanoes near Quito], Spain, Scotland and Northern Ireland, Mexico, Italy, and New Zealand. Within the United States Michael has visited national parks in southern Utah and the Grand Canyon, including a six-day raft trip through the Canyon, Acadia NP, and the Pacific northwest.

SPEAKER ABSTRACT

In this PGS holiday “geology lite” presentation we will examine volcanic areas in New Zealand, Nicaragua, and the South Pacific which are different in appearance but share certain characteristics of their violent origin. The plate tectonic proveniences of North Island NZ and Nicaragua are similar in their plate collision/subduction origin, while the French Polynesian Islands are mid-plate hotspot type volcanic features.

In the Taupo-Rotorua volcanic area of North Island NZ there are many geysers, hot springs, boiling mud pots and similar features familiar to anyone who has visited Yellowstone National Park. It is also a popular tourist attraction. The Telica & Leon area of Nicaragua has steaming mud pots in a much smaller area, and is a more relaxed tourist destination.

The idyllic islands of French Polynesia are legendary tourist destinations of lush green mountainous islands surrounded by exquisite beaches with traditionally tattooed native people mingling easily with hordes of visitors. Interspersed with the high volcanic islands are atolls which rise only a few meters above sea level. The succession of development of atolls from reefs bordering volcanoes can be seen in this archipelago.

About This Month's Cover Image

This month's cover shows Mount Ngauruhoe in New Zealand erupting in 1974. It is one of three active volcanoes in Tongariro National Park on the North Island. Others include Mount Ruapehue and Mount Tongariro itself, home to the world-famous Tongariro Alpine Crossing hiking trail. Mount Ngauruhoe is the youngest and most active of the three and has erupted over 70 times since 1839. The most common interpretation of its name is Nga-Uru-Hoe meaning 'throwing hot stones'.

Mount Ngauruhoe is a stratovolcano, producing andesite lava flows as well as the ash eruptions seen in the photograph. Its distinctive red color comes from scoria flows on its upper slopes and is probably what led director Peter Jackson to cast it as Mount Doom in his movie trilogy, *The Lord of the Rings*. You can experience a hike up the slopes of Mount Ngauruhoe (complete with appropriate music) by clicking on this link: https://www.youtube.com/watch?v=w8I5dwcuya8

Preview of our Next Meeting

Joint Dinner Meeting with PGS, ASCE and AEG

January 17, 2018

Applied Natural Sciences, Inc.

"Phyto-Integrated™ Remediation Systems and Results: Expanding the Function and Scope of Phytoremediation"

PRESIDENT'S STATEMENT

It has been stated frequently that the only constant in life is change. Of course we geologists are keenly aware of this on both broad and not-so-broad time scales from evidence of events in earth history and natural processes observed in real time. We know this from our personal lives as well. An example is my wife's and my imminent move to Greenville, South Carolina to be closer to our daughter, son-in-law, and grandchildren. Consequently—and most regretfully—this month will be my last as president of PGS. Over the past 16 months I've learned much about the function and operation of a community-oriented, professional society and I hope to have the chance to apply that knowledge in the service of a similar organization near my new home. I'm deeply grateful to the Board of Directors for their assistance and guidance and to all PGS members for their support.

I am also profoundly grateful for generosity of our donors. Once again it is time for our annual Corporate Sponsorship campaign. Sponsorship letters and forms have been mailed recently to current, past, and prospective sponsors whose monetary contributions to the Society is the life blood that supports our monthly operations and initiatives. And the initiatives are many. Among other activities, we are continuing to: 1) secure top-flight speakers for nine monthly meetings each year; 2) provide Continuing Education Credits (CEUs) to licensed professional geologists who attend the meetings; 3) provide networking and training opportunities to students; 4) supply judges to science and engineering fairs for budding scientists; 5) collaborate with earth science teachers through community-minded outreach to develop critical curricula for the next generation of geologists; and 6) provide annual field trips for our professional and student members to keep all in touch with geology in the field. If your company has not been approached and you would like to support the Society speak to any Board member and we will gladly provide you with a sponsorship form. The forms can also be found on our website. Contributions can be directed to our general fund or to the Galey Fund that supports student initiatives.

Above and beyond corporate sponsorship is the PGS Endowment Fund, established in May 2014 through the Community Foundation Serving the Heart of Western Pennsylvania. In accordance with the mission of the Foundation, the Fund is to be used for the charitable purpose of the support of the Society in the years to come. The "charitable purpose" of the Fund may be applied, in whole or in part, to the monetary needs of students (awards, membership, student meeting subsidization), community outreach, field trips, educational seminars, monthly operations, or whatever the Society's Board defines as a given charitable need. In essence, the Fund will provide a financial vehicle to protect the future longevity of the Society, in existence since 1945, for many years to come. Contributions can be made through bequests, memorials, and gifts to the Pittsburgh Geological Society / Endowment Fund or directly to the Community Foundation Serving the Heart of Western Pennsylvania. If you wish to seek any further information on the Fund, feel free to contact either Ray Follador, our Finance Committee Chairperson, at (724) 744-0399 or geodawg@comcast.net, or Mindy Knappenberger, Development Officer for the Community Foundation, at (724) 548-1261 or mindy@servingtheheart.org.

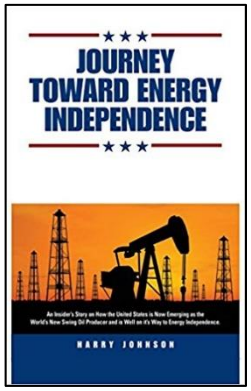
Speaking of generous contributions, I wish to thank Montrose Environmental Group, LLC, ACA Engineering, Inc., American Geosciences, Inc., Barner Consulting, LLC, and Pennsylvania Drilling Co. for their corporate sponsorships.

I hope you'll join us for our December meeting on the 20th. The December get-together is commonly referred to as Family Night and members are encouraged to bring their significant others. We purposely make our talks more accessible for the non-geologists. See you then.

Peter R. Michael

President

Holiday Gift Buying Guide for Geologists



We have some gift suggestions to pass along in case you have a fellow geologist as your Secret Santa assignment. From our friend Doug Patchen in West Virginia comes the recommendation of **'*Journey Toward Energy Independence*'** by Harry Johnson, formerly of DOE. The book traces the history of the petroleum industry from the Pennsylvania discovery of oil in 1859 to today, when the United States is once again emerging as the world's dominant oil and gas producer. Doug says, "I found it to be an easy read and quite interesting." (Amazon.com: http://a.co/3BKq2oA) Other books with a Pittsburgh geological connection include: '***Inconvenient Facts***' by local energy consultant Gregory Wrightstone (http://a.co/5LnJjLF); '***Roadside Geology of Pennsylvania'*** by Brad Diver (http://a.co/7qSHzFp) and of course the ever-popular PGS publication '***The Geology of Pennsylvania'*** (http://a.co/j2McpkJ).

For a more digital gift, you can check out the **Geology Sample Collector** app on the Google Play Store (https://play.google.com/store/apps/details?id=com.shopzeus.android.majorforms_1000) or **GeoFieldBook** on iTunes (https://itunes.apple.com/us/app/geofieldbook/id526812324) This app allows you to track and document your field work incorporating images, video, audio recordings, and text. It also allows you to track your path with GPS and then share it on your website or social networks. Once your collecting is completed, you can automatically create a PowerPoint or video of the sampling. And best of all, this gift is totally free!

The following members and friends of PGS have donated recently to the Galey Fund in support of student activities or to the PGS Endowment Fund:

Pennsylvania Council of Professional Geologists (for student night)
Wendell Barner
Karen Rose Cercone

GEOLOGICAL EVENTS

NATIONAL BROWNFIELDS CONFERENCE 2017

GEOPHYSICAL SOCIETY OF PITTSBURGH

December 5, 2017
"Effective Constraint of RTA Models Utilizing Microseismicity Derived Flow Attributes" presented by Ted Urbancic of ESG Solutions

Cefalo's Banquet & Event Center, Carnegie PA

PITTSBURGH ASSOCIATION OF PETROLEUM GEOLOGISTS

December 13, 2017
"PAPG, GSP and SEG Christmas Party"

Cefalo's Banquet & Event Center, Carnegie PA

AEG - GREATER PITTSBURGH CHAPTER

December 15, 2017
"Greater Pittsburgh Chapter Holiday Special"

Bar Louie, North Shore Drive, Pittsburgh PA

The Pittsburgh Geological Society is delighted to welcome the following professional members to the society:

Dustin J. Barnes
Staff Scientist
BJAAM Environmental, Inc.
2016 BS in Geology, Univ. of Pittsburgh

We are also happy to welcome the following new student members:

From California University of Pennsylvania:

Brett E. Kusniar
Ashleigh V. Schimmel

From Slippery Rock University of Pennsylvania:

Jordan M. Ayoub
Dalton E. Carbaugh
Kassa R. Kocjancic
Kelsie N. McGranahan
Henry P. Thornton

We look forward to seeing all of you at an upcoming society event!

PGS Wants to Hear from You!

The Board of Directors invites all members of the Pittsburgh Geological Society to submit their ideas for:

- Speakers and/or topics for future monthly meetings
- Ideas for future PGS annual spring field trips
- Volunteers willing to lead or help lead annual field trips
- Suggestions for ways to mentor PGS student members
- Volunteers to help mentor PGS student members

So stop using your smart phone to look up geological maps and send us your feedback by email or on the web.

THE ORIGIN OF WESTERN PENNSYLVANIA PLACE NAMES

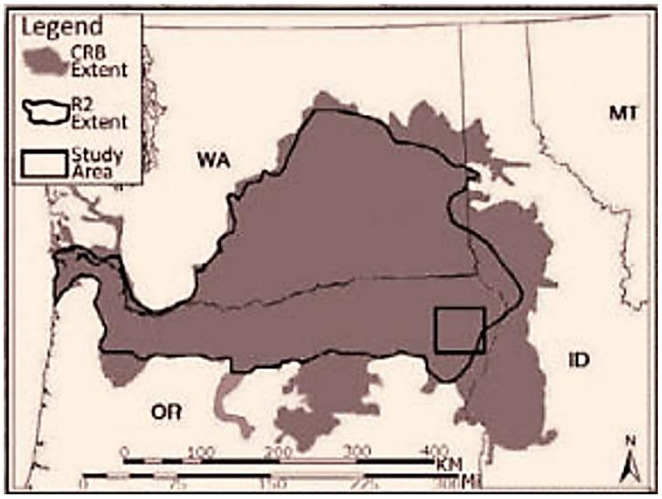
When land patents were issued for the area south of the Ohio and Monongahela rivers in the late 1700s, David Strawbridge bought land along Sawmill Run in what was then a part of Lower St. Clair Township, Washington County. He named his farm "Castle Shanahan" to acknowledge his Irish roots. By the time he died in the late 1700s, the area was part of Allegheny County. Strawbridge's family broke up the property, incorporating it into other farms, which gradually became a rural community.

A 1912 photo of part of the business district of Castle Shannon.

Although they kept Strawbridge's original name for a while, eventually the name "Shanahan" morphed into "Shannon". Coal mining became a major industry in the late nineteenth century along with greenhouses for floral bouquets, bringing many immigrants to work in the area. The first of the railroads to connect Castle Shannon to Pittsburgh was completed in 1872, and the railroad owners raffled off lots to prospective buyers who came out on the new railway. To attract more city dwellers to this 'distant' suburb, an amusement area was created in an area full of linden trees. This later became The Linden Grove Nightclub which is still hosting live bands, dances and special events in Castle Shannon, nearly 150 years later.

DID YOU KNOW . . . ?

We're probably all familiar with the Columbia River Basalt Group, the Middle and Late Miocene volcanic flood basalts that engulfed 63,200 mi^2 of Washington, Oregon, and Idaho**.** Eruptions were most vigorous 17–14 Ma, when over 99 percent of the basalt was released. Starting about 16.5 Ma, vents in southeast Washington and northeast Oregon sent a series of lava flows across the area that reached almost as far as Canada and the Pacific Ocean. These flows created the Wapshilla Ridge Member of the Grande Ronde Basalt, a more than one-mile-thick pile of basalt that is considered to be one of the largest mapped flood basalt units on Earth, according to a team of scientists from Washington State University and Australia.



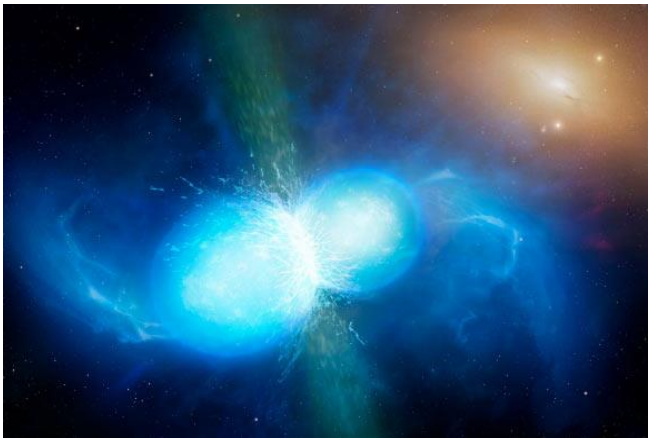
Extent of the Columbia Basalt lava flows (brown), with the region within the black line showing the Wapshilla Ridge flow that emitted more than 200 billion tons of sulfur dioxide. The small square shows the area of the study.

Only two other eruptions we know of were larger, the Siberian Traps eruption at the end of the Permian and the Deccan Traps eruption at the end of the Cretaceous that might have been at least partly responsible for two of the planet's greatest mass extinctions. The research team estimated that, over tens of thousands of years, the Wapshilla Ridge eruption put out between 242 and 305 billion tons of sulfur dioxide that would have been devastating to the entire region because of the acid-rain effect from the eruption. The Wapshilla eruption created a "Year Without A Summer", resulting in food shortages across the northern hemisphere that would have been extremely hard on biota. Yet, although it had a global effect on temperatures, it wasn't drastic enough to kill plants and animals or to affect the fossil record.

Although most of the gases were released during the eruption, some remained trapped in crystals near the volcanic vents that allowed the research team to sample melt inclusions and host glasses preserved in near-vent deposits associated with the lavas. They found that sulfur contents ranged up to 0.19 weight percent, whereas host glasses were variably degassed with 0.01-0.13 weight percent of sulfur. They determined these data to mean that the Wapshilla Ridge Member released 242-305 gigatons of SO_2 to the atmosphere over a maximum of 94,000 years. Not by coincidence, it turns out that this occurred during the time known as the Miocene Climatic Optimum when 50 Ma of cooling was interrupted by 5°F to 6°F of warming.

http://www.sci-news.com/geology/wapshilla-volcanic-eruption-05308.html

We've known for years that many of the chemical elements of the Periodic Table are created in the nuclear furnaces of stars such as our sun. However, astronomers have wondered for years where the heavier elements such as gold, lead, and uranium come from. Now there is evidence that they are created in the collision or merger of neutron stars, thanks to a gravitational wave source detected by an international collaboration of astronomers and astrophysicists.



An artist's depiction of merging neutron stars.

The neutron star merger, labeled GW170817, was detected in August, and immediately the astronomical community was alerted so everyone could train their telescopes on the phenomenon. The measured gravitational waves, ripples in space and time, suggested a neutron star merger because each star in the pair weighed between 1 and 2 times the mass of our Sun.

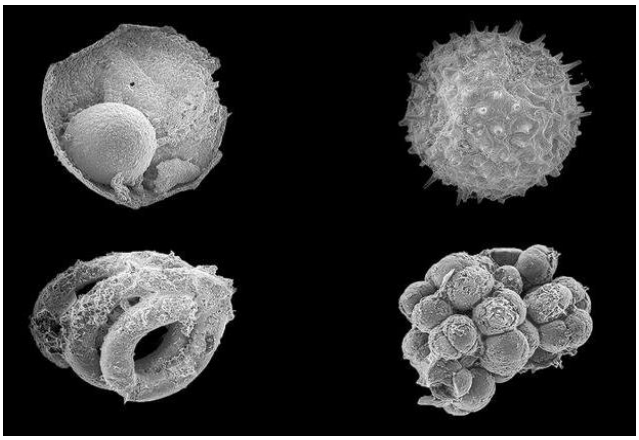
In addition, at 1.7 seconds after the gravitational waves were recorded, the Fermi Gamma-ray Space Telescope detected a short burst of gamma rays from the same region, giving solid evidence that concentrated jets of energy are produced during the merger of neutron stars. Then, less than 11 hours later, astronomers saw visible light from the source, situated in a lenticular galaxy known as NGC 4993 about 130 million light years from Earth in the direction of the constellation Hydra.

The team speculated that two neutron stars once spiraled around each other very rapidly, and as they grew closer together they were spinning as fast as a blender. Powerful tidal forces tore huge chunks off while the remainder collided and merged, forming a larger neutron star or a black hole. The chunks that were spewed out into space were freed from the crushing pressure of the neutron stars, allowing the neutrons to turn back into protons and electrons that formed a variety of chemical elements heavier than iron, such as gold, platinum, and uranium.

The researchers said they had directly witnessed a cloud of freshly-made precious metals right at their production site. The discovery answered three questions that astronomers have been debating for decades: 1) what happens when neutron stars merge? 2) what causes short-duration gamma-ray bursts? and 3) where are the heavy elements such as gold made? So, if you think gold is precious beyond the dreams of avarice, think again. It is merely slag discarded from merging neutron stars.

http://www.sci-news.com/astronomy/origin-universes-heaviest-elements-neutron-star-mergers-05330.html

A team of paleontologists from Yale, Harvard, and Amherst universities has discovered embryo-like microfossils in northern Mongolia that might answer some question about when microbes became multicellular animals on Earth. The microfossils were discovered in the Khesen Formation in northern Mongolia, dated at about 540 Ma. The site is considered one of the most significant for early Earth fossils since the discovery of the 600 Ma Doushantuo Formation in southern China about 20 years ago because determining how and when multicellular animals evolved has been very difficult. The discovery of exceptionally well-preserved fossils that resemble animal embryos provides a new window into a critical transition in life's history.

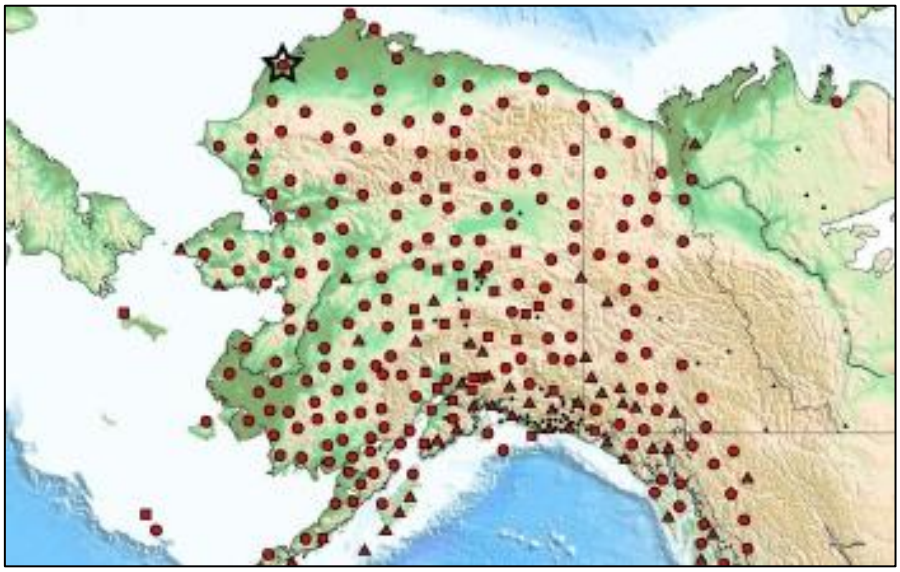


Microfossils from the Ediacaran of Mongolia. Each fossil is about 200 microns in the maximum dimension.

The microfossils have been classified into eight genera and about 17 species comprising 10s to 100s of individuals. Many of them are acritarchs, microfossils about 100 microns in size. The Khesen Formation contains phosphorites, sedimentary rocks that often preserve extremely small fossils and delicate structures. Discovery of the fossils may help scientists validate a much earlier date for the existence of Earth animal ecosystems, rather than just microbes. Since the discovery of the Doushantuo Formation, paleontologists have debated the findings with no resolution. If the Khesen microfossils really are animals, rather than microbes, they represent the oldest animals yet found in the geological record.

https://www.sciencedaily.com/releases/2017/10/171023123530.htm

A new seismic station, part of EarthScope, is one of hundreds of stations collectively called the Transportable Array that covers the lower 48 states and Alaska coast to coast with a grid of stations at nearly 1,700 sites. EarthScope is a project constructed, operated, and maintained by the Incorporated Research Institutions for Seismology (IRIS). The new station, A19K, situated at the edge of an abandoned airstrip in northern Alaska, is way out in the middle of nowhere - the nearest population center, Utqiaġvik (formerly called Barrow), the northernmost city in the United States, is 127 mi. away.



Map of EarthScope Alaska Transportable Array stations (red symbols). Circles represent the new stations.

A19K is the last in a 280-station Alaska seismic network that continuously records ground motion from earthquakes and broadcasts the data in real time. EarthScope scientists are using the Transportable Array to explore the structure and evolution of the North American continent, and the processes controlling its earthquakes and volcanic eruptions.

Deployment of the Transportable Array in Alaska will help researchers understand earthquakes in Alaska, map faults, assess seismic hazards throughout the state, and image the crust and deep-Earth structure beneath Alaska. The Transportable Array enables scientists to image the interior of the Earth to depths of several hundred miles. And, while it is in operation, it will enhance the observation and warning capabilities for earthquakes, tsunamis, and volcanic eruptions. This is important because Alaska is the most seismically active state in the US, registering more than 25,000 earthquakes every year, but it also had relatively few stations to monitor seismic activity, mostly located in the populated southern part of the state.

Alaska was the final goal for the Transportable Array ever since stations began to be installed in the lower 48 states in 2004. It was also the hardest. EarthScope scientists indicated that setting up and operating the array in the lower 48 allowed them to learn how to scale up their operations before moving to challenging environments and terrain such as Alaska offered. Where stations were installed in the lower 48 using trucks and backhoes to create vaults for the equipment, installation in Alaska required helicopters in many areas. Field teams used specially designed lightweight drills to make 10-foot boreholes in rock, permafrost, and other ground conditions, then placed a posthole seismometer into each hole and connected it to a hut containing the necessary electronics, batteries, and solar panels.

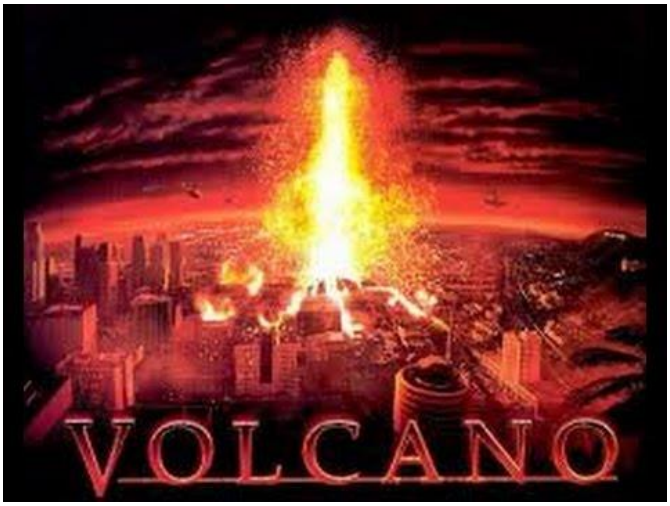
Signals from the sensors are sent to the Array Network Facility in San Diego in real time as soon as a station is built, and all data are made available free to the public. The benefits of the Alaska Transportable Array stations are not just for Alaskans, since the research will improve our understanding of earthquakes from one of the best earthquake "laboratories" on the planet. It is allowing scientists to view the interior of the Earth with great clarity. Right now, the stations are planned to remain in Alaska through 2019, but researchers are looking to see if they can extend those stays. EarthScope researchers in the lower 48 transferred 158 Transportable Array stations to a longer-term seismic station sub-array, so many are hoping a similar plan can develop for the Alaska array.

https://www.nsf.gov/news/news_images.jsp?cntn_id=243286&org=NSF

Have you seen the movie “Volcano” about flaming magma erupting from the La Brea tar pits in Los Angeles while Tommy Lee Jones saves the world? Silly, right? Well, according to one scientist, bad geology movies like that can help foster scientific literacy. Geophysicist Seth Stein is a professor at Northwestern University. In his opinion, geologists can complain about all the gross mistakes that occur in movies or they can say, "hey, this is a really great opportunity to get the class interested." Scientific errors in movies, from ginormous tsunamis to caves at depths that would put them in the Earth's mantle, can be used to teach both scientific lessons and a healthy sense of skepticism.

Stein trains his students to spot errors and seek out true explanations, by incorporating “scientifically disastrous disaster movies” into his classroom lessons on tectonics, Earth's interior, and geophysical data analysis. And, since there's no shortage of scientific bushwah to choose from, students can learn a great deal. Take 2003’s “The Core”, for example. A team of so-called scientists travel into the Earth's core inside a drilling machine (shades of Edgar Rice Burrough’s “At the Earth’s Core”!) where they find huge voids and fields of minerals in the planet's interior. In 1997’s “Dante’s Peak”, a volcanologist from the USGS drives a pickup truck across a lava flow and all that happens is the rubber tires burn up. And in October, the movie “Geostorm” hit theaters. According to this movie, a weather-controlling satellite system freezes village in Afghanistan and stirs up packs of tornadoes like hungry wolves on unsuspecting civilians.

By identifying errors like these and learning why they're inaccurate, Stein says he offers students an entertaining way to connect with their inner skeptic, which he considers to be a vital trait for young scientists in training. "Scientists are supposed to be skeptical," he notes. "We're not supposed to believe what authorities tell us. We're supposed to question and challenge everything." The errors go well beyond Hollywood. Stein says he has found blatant inaccuracies in educational software, museum animations, geology textbooks, etc.



The movie “Volcano” can be a valuable teaching tool in the right hands.

Fortunately, many movies and television crews are including scientific consultants. Because of this, movies like 2015’s “The Martian”, which had NASA specialists as part of the production process, is considered to be one of the more accurate films to have been screened. The only problematic part was the wind storm that destroyed the mission at the beginning of the movie. Although Mars does have very high wind speeds, the density of the atmosphere is so low that the wind wouldn’t have done any real damage.

You’ve probably seen many of these blatantly bad movies and gritted your teeth. But then, regardless of how improbable their “scientific” basis might be, they can still be very entertaining. Where would the world be today without movies like “Frankenstein” and “Plan 9 From Outer Space”? (Okay, I’m only fooling about Plan 9, judged to be the worst movie ever made!)

https://www.sciencedaily.com/releases/2017/10/171023094627.htm

A number of scientists have been credited with discovering the greenhouse effect, wherein CO_2 and other gases trap heat in the Earth's atmosphere. Most credit Irish physicist John Tyndall, who published a series of studies on the subject in 1859. Others credit Swedish chemist Svante Arrhenius who proposed a relation between atmospheric CO_2 concentrations and temperature, and claimed in 1896 that fossil fuel combustion would eventually result in enhanced global warming.

Eunice Foote was the first to write about the greenhouse effect.

But actually the credit should go to American Eunice Newton Foote (1819-1888) an American scientist, inventor, and women's rights campaigner from Seneca Falls, New York, whose paper on the warming effect of the sun on air, including how it was increased by CO_2, was presented by Prof. Joseph Henry to the AAAS meeting in 1856 because women were not welcome in the hallowed halls of science!

Give Professor Henry credit for prefacing his reading of the paper with a statement that science had no national boundaries nor gender identity. "The sphere of woman embraces not only the beautiful and the useful, but the true."

https://en.wikipedia.org/wiki/Eunice_Newton_Foote

What is especially difficult to determine about the greenhouse effect and global warming is figuring out how much of the climate system is driven by human activity. What we burn on Earth ends up in the atmosphere, at least, at first. But what happens to CO_2 after that? Although some remains in the atmosphere for hundreds of years, as much as half of annual global emissions is used by oceanic microorganisms for photosynthesis. But what about the rest?

Now, a three-year NASA mission has given researchers help in tracking how CO_2 moves across the Earth. The Orbiting Carbon Observatory-2 (OCO-2) has provided scientists with new details into critical CO_2 flows around the world, for example, how El Niño conditions can change the pace of the global CO_2 rise; where CO_2 travels after leaving a volcano or the metropolitan Los Angeles; how photosynthesis responds to increased carbon in the atmosphere.

The satellite complements a network of about 150 greenhouse gas monitors on the ground to give climate scientists even more detailed looks at the composition of the atmosphere. The satellite's instruments analyze the atmosphere from 440 miles above the Earth's surface, but they can also image features on the ground. Although cities are responsible for more than 70% of human-generated CO_2 emissions, ground-based monitors have not been able to provide targeted data. The satellite, on the other hand, can detect not only the pollution differences between cities and rural areas, but also differences within cities.

NASA's Orbiting Carbon Observatory-2 measures Earth's atmospheric carbon dioxide concentration.

https://www.bloomberg.com/news/articles/2017-10-12/nasa-probe-reveals-power-plants-pollute-more-than-volcanoes

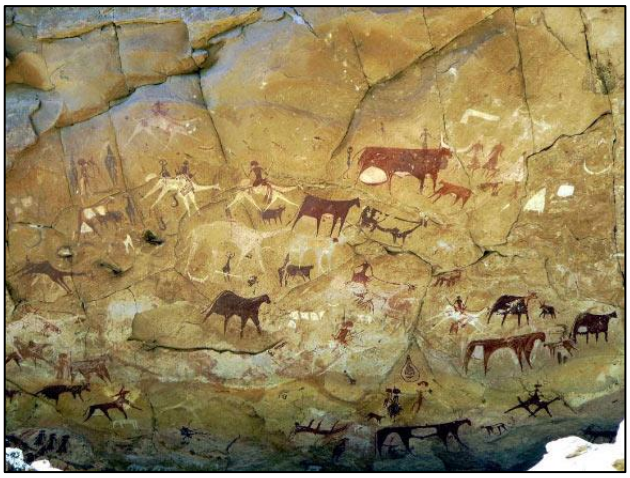
In the future, we might not need the kind of extensive sensor network currently being operated by EarthScope to detect earthquakes. Perhaps all we'll need will be our currently existing fiber optic lines because scientists have developed technology that detects seismic activity through jiggling in those lines. Laser interrogators watch for disturbances in the fiber and send information about the magnitude and direction of tremors. This system can detect different types of seismic waves, thus determining the seriousness of the threat. It can also spot minor and localized quakes that might otherwise never be detected.

Fiber-based detection really isn't new; previously, it was used as an acoustic sensing system that required wrapping the lines in cement, sticking them to a surface like a concrete wall – whatever was necessary in making sure they were in contact with the ground. This was done to make it easier to spot impurities in the signal. With the new method, you can use existing fiber lines housed in plastic pipes, so it would be a lot easier and cheaper to put these detectors to use.

There are many challenges to making this a reality, of course (nothing is ever as easy as it sounds). First of all, it is limited by the size of the fiber network, so it would miss many rural areas that don't have much, if any fiber. Secondly, the current proof that the concept works is based on a 3-mile loop around Stanford University. It could be much more daunting to have to run a sensor network across an entire city, or worse, across the entire country. Still, it could be far more affordable than the EarthScope system, and the sheer precision of using fiber could provide earthquake data that hasn't been an option before.

https://www.engadget.com/2017/10/22/fiber-optic-lines-double-as-earthquake-detectors/

When and why our ancient human ancestors left Africa has been debated for many years. The standard story is that humans were able to leave because the climate at that time was wet, and it allowed them to cross the more arid Horn of Africa and Middle East. Now, new findings contradict that, suggesting that ancient humans left Africa to escape a drying climate about 60,000 years ago. Some humans may have left Africa earlier than that, but new genetic research indicates that the main migration out of the continent probably occurred between 55 Ka and 70 Ka years ago. And new geologic research suggests that northeastern Africa was hot and dry then.

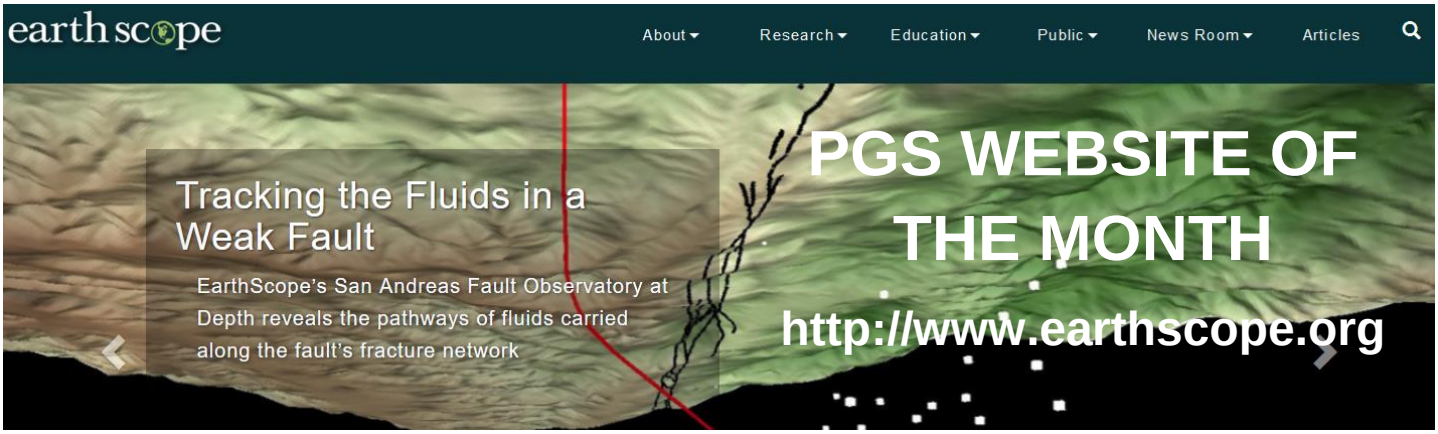


Prehistoric rock paintings in Manda Guéli Cave in the Ennedi Mountains, Chad, Central Africa

The researchers obtained a core of ocean sediments taken in the western end of the Gulf of Aden near Somalia and used it to trace the climate back to about 200 Ka. They analyzed the sediment layers for alkenones, chemicals produced by a particular kind of marine algae, whose composition can be used to determine the sea surface temperature when the algae were alive. The data also reflect regional temperatures. The researchers then analyzed the ancient leaf wax that had been blown into the ocean from terrestrial plants to determine the region's ancient rainfall patterns. Plants can adjust the chemical composition of the wax on their leaves to offset the effects of wet or dry climate, so the leaf wax in the sediment core layers provided a record of past fluctuations in rainfall.

The data from the alkenones and leaf wax allowed the researchers to reconstruct temperature and aridity in the Horn of Africa region over the past 200,000 years. They found that, around 70 Ka years ago, just before the main migration of 65 Ka to 55 Ka, the climate in the Horn of Africa shifted from wet and warm to conditions that were colder and even drier than the region today.

http://www.sci-news.com/geology/humans-out-of-africa-escape-drying-climate-05331.html



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Fun Fact Having Nothing to Do with Geology

The microwave oven was invented by mistake when an engineer testing a magnetron tube noticed that the radiation from it melted the chocolate bar he had in his pocket.

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